# METHOD AND SYSTEM FOR PROVIDING AND CONTROLLING DELIVERY OF CONTENT ON-DEMAND OVER A CABLE TELEVISION NETWORK AND A DATA NETWORK

## FIELD OF THE INVENTION

**[0001]** The present invention relates to the provision of content on-demand, and more particularly to the provision of content on-demand by way of a cable television network.

## BACKGROUND OF THE INVENTION

**[0002]** The desire to provide home television viewers and listeners with the ability to view video and listen to audio on-demand has existed for some time. In recent years, the introduction of high capacity data networks and improved video and audio compression techniques has made the availability of audio and video content on-demand possible.

**[0003]** For example, high capacity packet or circuit switched networks may be used to carry digital video or audio streams for delivery to suitable viewer or listener appliances. The public internet, private packet switched networks, ATM networks, and broadband ISDN networks have all been suggested as appropriate delivery networks for content on-demand. Complementary viewer or listener equipment located at the customer premises may be addressed over such networks to receive and present the content. Example equipment includes internet appliances, intelligent set-top television boxes, or personal computers with appropriate software. Characteristically, these appliance may typically be uniquely addressed over the delivery network; decode and present the video or audio stream; and permit two-way communication over the delivery network to place on-demand orders and control the playing of the content on-demand.

**[0004]** Existing cable television network operators are also well positioned to

provide content on-demand over existing networks. As such, cable television networks have been gradually updated, and continue to be updated, to allow provision of digital content, pay-per-view programming, two-way data access, and ultimately content on-demand. Existing cable subscribers expect these services to be delivered by the cable network operators over the medium with which they are familiar. Moreover, cable network operators have access to content, and experience in providing pay-per-view content.

**[0005]** Cable network operators are also uniquely affected by the constant need to upgrade customer premises equipment. Many subscribers have only recently upgraded set-top-boxes to obtain digital content and enhanced pay-per-view offerings. New features and improvements in user interfaces drive an incessant desire to upgrade these boxes.

**[0006]** Providing content on-demand typically requires additional upgrades. Unlike other customer premises equipment, cable network set-top boxes are typically owned by the cable network and not by subscribers. Upgrading these is therefore costly to the network operator, and even more costly if customer premises equipment for all subscribers is upgraded. Subscribers, on the other hand, often find the need to constantly upgrade as intrusive and bothersome. Allowing subscribers to upgrade equipment only as content on-demand is requested, on the other hand, is more cost efficient but prevents the content from being provided to many subscribers - subscribers who do not have the necessary upgrade simply do not have access to the content. Even subscribers who want the new content may not believe it warrants the effort of an upgrade.

**[0007]** Some existing cable set-top boxes address this dilemma by permitting software upgrades that may be initiated by the network operator, and provided to subscribers transparently over the existing cable network. These upgrades allow set-top boxes to support new features and services. Unfortunately, existing hardware often limits the type of scope of the upgrades. The amount of memory, processor speed, and chipset functionality at existing set-top boxes, for example,

limit the types of upgrades that are possible. Provision of content on-demand, for example, often requires sophisticated interface software, or hardware upgrades providing, for example, additional remote control functions, two-way data access and the ability to present and navigate extensive lists of available content.

**[0008]** Accordingly, there is a clearly a need to allow existing cable television subscriber and other customers access to content on-demand, while reducing the need to upgrade existing customer premises equipment.

## SUMMARY OF THE INVENTION

**[0009]** In accordance with an aspect of the present invention, content on-demand is delivered by way of cable network. Provision of such content is controlled by over data network. Advantageously, a user interface at a conventional computing device may be used order content and to control its delivery and playing.

**[0010]** Commands from the computing device may be provided by way of data network to a network interconnected server. The server under software control causes a media receiver at the customer premises to be properly tuned to receive content on-demand, and content on-demand to be played, as requested by the computing device. Advantageously, the media receiver may include a conventional set-top box that may be tuned remotely in response to a customer placing an on-demand order. As such, no additional hardware or hardware upgrades need be provided by the cable network operator to the customer to provide the content on-demand.

**[0011]** In accordance with an aspect of the present invention, there is provided a method of providing content on-demand to a customer having at least one tunable media receiver interconnected with a cable television network, and a computing device separate from the media receiver and in communication with a data network. The method includes receiving from the computing device over the data network, an indicator of an identity of the customer and a request for a

media stream; remotely tuning one of the at least one tunable media receivers over the cable television network, to receive the content over the cable television network on a tuned channel that is not otherwise tunable by the customer; and providing the content over the cable television network for receipt and presentation by the media receiver, when tuned to the tuned channel.

**[0012]** Other aspects and features of the present invention will become apparent to those of ordinary skill in the art upon review of the following description of specific embodiments of the invention in conjunction with the accompanying figures.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0013]** In the figures which illustrate by way of example only, embodiments of this invention:

**FIG. 1** illustrates an exemplary cable television network for use in association with a content on-demand system;

**FIG. 2** illustrates a system for delivering content on-demand, exemplary of an embodiment of the present invention;

**FIG. 3** illustrates a simplified organization of a database used by the system of **FIG. 2**;

**FIG. 4-7** illustrates windows forming part of a user interface for ordering and controlling playing of content on-demand;

**FIGS. 8A**, **8B** and **8C** is a flowchart illustrating exemplary steps executed at a network server of the system of **FIG. 2**;

**FIGS. 9A**, **9B** and **9C** are flowcharts illustrating exemplary steps executed at a media server proxy of the system of **FIG. 2**; and

**FIG. 10** is flowchart illustrating exemplary steps executed at a media server of the system of **FIG. 2**.

DETAILED DESCRIPTION

**[0014]** **FIG. 1** illustrates an exemplary distribution network **50** for use in association with a content on-demand system **10**. Exemplary distribution network **50** is a conventional cable television network, known by those of ordinary skill in the art. Network **50** will therefore only be briefly described herein.

**[0015]** As illustrated, network **50** includes a regional cable head-end **70** interconnected with a high capacity transport network **72**. Transport network **72** may be a SONET, WDM, ATM or similar network or a combination of these, interconnected as a ring or star network. Transport network **72** includes a plurality of interconnected distribution hubs **74**. In typically cable television networks, distribution nodes **76** are hybrid fiber-coax nodes. Each distribution node **76** provides cable television signals to multiple (typically 500-1000) customers. As will be appreciated, cable television signals are provided to customer media receivers **52** (comprising, e.g., televisions with set-top boxes) by way of coaxial cable carrying RF signals in a frequency range between 0 and 750 MHz (or greater). These RF signals are divided into RF channels, with each RF channel being a 6 MHz base-band signal. Multiple RF channels are multiplexed together to form the RF spectrum of the signals delivered over the network. Each 6 MHz RF channel in turn may carry a standard analog TV signal, or multiple streams of digital video, or other data. Each RF channel may, for example, transport multiple digital signals, that may for example represent MPEG or MPEG2 encoded video signals.

**[0016]** In example network **50**, each distribution node 76 receives and provides to customers a **750** MHz spectrum of RF channels. The spectrum at node **76** each may be different. Although some RF channels may be common, other RF channels may be unique to a particular node . RF channels unique to

a node are often referred to as RF narrowcast channels, while RF channels common to all nodes are referred to as RF broadcast channels. The spectrum for any distribution node 76 may be assembled at the cable head-end, or any combination of the cable head-end, distribution hub, and node . A unique spectrum may be created by injecting an RF narrowcast channel at the head end or at a hub into a specific RF channel for the node. The head-end may, for example, assemble the spectrum containing a plurality of broadcast RF channels to be received by all customers, and a further plurality of unique narrowcast RF channels to be received by customers at one (or several selected) node(s).

**[0017]** Content on-demand may be provided over network **50** to network customers receiving signals from a particular node **76**, by assembling RF signals containing the content at head-end **70** and propagating them to the node **76**. Content, as used herein, may include audio, motion video, multi-media content, and the like. The content is thus received by all customers served by the node **76** but is only accessible (e.g. viewed or listened to) by the customer of distribution node 76 who has ordered the content. This limited access may, for example, be achieved encrypting the content in a data stream provided on the RF channel, so that the content may be decrypted only by the customer who has ordered and paid for it.

**[0018]** In a conventional cable television network, video-on-demand is delivered as described above. Typically, orders are placed by way of sophisticated set-top boxes at the customer premises. Content is contained in data streams containing MPEG or similar data. As noted, however, most cable television customers do not have set-top boxes capable of providing a suitable user interface to navigate, order and control content large libraries of content on-demand. As such, in a manner exemplary of the present invention, exemplary system **10** enables customers with customer premises equipment that may otherwise be ill-suited for the navigation available content on-demand, to browse available content on-demand, order it, and control its playing, using a data network and a conventional computing device.

[0019] **FIG. 2** illustrates system **10** for delivery of content on-demand, exemplary of an embodiment of the present invention. System **10** is preferably installed at the premises of an associated distribution network operator at, for example, cable head-end **70** of distribution network **50** as shown in **FIG. 1**.

[0020] System **10** is in communication with content on-demand customers in two ways. First, system **10** is interconnected with distribution network **50** to which customer media receivers **52** are connected. Second, system **10** is interconnected with a data network **20** to which a customer computing device **12** may be connected. As will become apparent, data network **20** provides two-way communications with customers for the purpose of providing customers with a suitable interface for navigating and selecting content on-demand, placing on-demand orders and controlling its delivery and playing. In the present embodiment, data network **20** is the public internet. Of course, data network **20** could be a private data network, or a data network other than the internet.

[0021] As illustrated in **FIG. 2**, in one embodiment, exemplary system **10** includes a network server **22**; a database **62**; a media server (MS) **46**; a media receiver controller **48**; and a media server proxy **34**.

[0022] Network server **22** is a conventional network aware computing device such as a Microsoft NT server; Linux server, or the like. Example server **22** includes a computer network interface physically connecting server **22** to data network **20**, and a processor **24** coupled to conventional computer storage memory **26**. Example server **22** may further include input and output peripherals such as a keyboard, display and mouse (not illustrated). As well, server **22** may include a peripheral (also not illustrated) usable to load software **30** exemplary of the present invention from a software readable medium, such as medium **32,** into its memory **26** for execution. Alternatively, or in addition, software **30** may be stored in non-volatile memory **28**.

[0023] Software **30** may include conventional operating system software; a hypertext transfer protocol ("HTTP") server application; and integration software,

exemplary of embodiments of the present invention.

**[0024]** The operating system software may, for example, be the Linux operating system software; Microsoft ® Windows 2000 ® operating system software; or the like. This operating system software preferably also includes a TCP/IP stack allowing communication of server **22** with data network **20**.

**[0025]** The HTTP server application is preferably an Apache, ColdFusion ®, Netscape ®, Microsoft ® IIS or similar web server application, also in communication with the operating system and a database **62** (described below). The HTTP server application allows server **22** to act as a conventional HTTP server, and thus provide a plurality of HTTP pages for access by network interconnected computing devices. HTTP pages that make up these pages may be implemented using one of the conventional web page languages such as hypertext mark-up language ("HTML"), Java™, ASP, Javascript or the like. These pages may be stored as files within stored in non-volatile memory **28**.

**[0026]** The integration software adapts server **22**, in combination with database **62** (described below), its operating system and HTTP server application, to function in manners exemplary of embodiments of the present invention. The integration software acts as an interface between the database **62** and the HTTP server application and may process requests made by interconnected computing devices. In this way, the integration software may query and update entries of database **62** in response to requests received over network **20**, in response to interaction with presented web pages. Similarly, integration software may process the results of customer input and queries, and present results to database **62**, as detailed herein. Integration software may for example, be suitable CGI or Perl scripts; Java™; Microsoft ® Visual Basic ® application, C/C++ applications; or similar applications created in a conventional ways by those of ordinary skill in the art.

**[0027]** Database **62** is a conventional database that may be hosted on a separate database server (not specifically illustrated) or co-hosted with either

proxy **34** or server **22**. Database **62** may be a relational or object-oriented database for example. The database **62** is accessible by the application software of server **22** by way of a database engine (not illustrated). This database engine may be a conventional relational database engine, such as Microsoft ® SQL Server, Oracle ®, DB2, Sybase ®, Pervasive ® or other database engine known to those of ordinary skill in the art. The database engine typically includes an interface for interaction with operating system software at server **22** and proxy **34**, and other application software, such as integration software at server **22**. Ultimately, this database engine is used to access, add, delete and modify records at database **62**. As will be appreciated, records within database **62** are used to create and track content on-demand orders. The database **62** is accessible (read/write access) by both the server **22** and proxy **34**.

**[0028]** Media server **46** ("MS") is a content on-demand server, capable of content storage and playing on-demand over an interconnected distribution network. In one embodiment, media server **46** is a conventional cable network content on-demand delivery server, such as an nCUBE ® n4 Media Hub; Concurrent Computer Corporation ® Media Hawk; or similar commercially available device. Media server **46** includes storage facilities for storing content on-demand; a control network interface for receipt and provision of control communications; and a distribution network output. Media server **46** may store a variety of different content types, including data in MPEG, MPEG 2, MPEG 4 or other formats representing video in NTSC, ATSC or other formats; digitized audio, in PCM, MP3, Real Audio, Microsoft Media or other formats, or mixed video/data and the like. Media server **46** receives control information for delivery of content on-demand to specific delivery network nodes by way of its control interface, and provides content on-demand to customers by way of its distribution interface, in a conventional manner, and as detailed below. Media server **46** may inject an digital stream carrying content delivered on-demand (typically an MPEG **2** stream) into a specific RF channel destined to a particular distribution node 76 (**FIG. 1**).

[0029] Media receiver controller **48** is a control device capable of remotely controlling operation of media receivers **52** at customer premises. In the illustrated embodiment, controller **48** is an out of band modulator capable of creating out-of band signals for controlling existing media receivers (detailed below), typically in the form of set-top boxes, by injecting a suitable control signals within an out-of-band control channel provided to set-top boxes at node s **76**. Controller **48** also receives control information by way of a suitable control interface, such as an Ethernet interface, or the like. An example controller **48** may include a Motorola Digital Headend OM **1000**, Scientific Atlanta Digital Network Control System, or the like.

[0030] Media server proxy **34** acts as an interface between media server **46**, controller **48** and network server **22**. Proxy **34** is also conventional computing device, and includes suitable communications interfaces and software to communicate with network server **22** and media server **46**. Proxy **34** includes a processor **36**, in communication with memory **38**. Memory **38** may store application software **42**, adapting proxy **34** to function in manners exemplary of the present invention. Proxy **34** may further include input and output peripherals such as a keyboard, display and mouse (not illustrated). As well, proxy **34** may include a peripheral (also not illustrated) usable to load application software **42** exemplary of the present invention from a software readable medium, such as medium **44,** into its memory **38** for execution. Alternatively, or in addition, software **42** may be stored in non-volatile memory **40**.

[0031] For simplicity controller **48**, media server **46**, server **22** and proxy **34** may all include suitable Ethernet interfaces for interconnection, and exchange of control information and data. They may, for example, be interconnected in a private local area network. In this way, server **22**, proxy **34**, controller **48**, and media server **46** may communicate with each other using conventional network and control protocols, supported by those devices, and understood by application software **30** and **42**.

**[0032]** As noted, system **10** is in communication with at least two appliances at each customer premises that are used to order, receive and control content on-demand, namely, a computing device **12** and one or more media receivers **52** (sometimes referred to as client display terminals (CDTs)).

**[0033]** Computing device **12** is a network aware appliance that presents a user interface for the ordering and control of content on-demand. Device **12** is in communication with the data network **20** over link **18**. Link **18**, may for example be a telephone link, wireless network link, ADSL or ISDN link, or the like. Through communication with data network **20**, device **12** is capable of communicating with network server **22** of system **10**. Device **12** may be a conventional home computing device including a processor, memory, interface peripherals, keyboard, and monitor. Alternatively, device **12** may be any other network aware device capable of controlling content on-demand, in manners exemplary of the present invention. Device **12** may, for example, be a cellular telephone, personal digital assistant, mobile computing device (such as a "Web Pad"), or the like.

**[0034]** In one embodiment, exemplary device **12** is pre-loaded with software that is capable of downloading and presenting internet content in the form of web-pages or the like. Device **12**, may for example, store and execute a suitable web browser such as a Microsoft ® Internet Explorer, Netscape ® Navigator/Communicator, Opera or similar web browser.

**[0035]** Media receiver **52** is a tunable device or combination of devices, capable of tuning to a channel carrying content on-demand, extracting and presenting this content. Multiple receivers **52** may be situated at a customer residence. Optionally, media receiver **52** may include an integrated display or listening device **82**, such as a television, audio amplifier, monitor or the like. Alternatively, media receiver **52** may present content to another device for display or listening. Media receiver **52** may, for example, be formed as a conventional set-top box **80**, for receipt and decoding of MPEG 2 streams by way

of cable network **50**. The content on-demand channel may be a digital stream delivered to the receiver **52** from and interconnected node **76**, and provided by media server **46**.

**[0036]** Typical example set-top boxes **80** include Motorola ® models DCT 1000, DCT 1200, DCT 2000, DCP 501, and DCT 503; Scientific Atlanta Explore models 2000 and 3000; Pace Microsystems models Pace500 and Pace700; or other comparable available devices.

**[0037]** Characteristically, the enumerated set-top boxes may be tuned to a channel transporting content on-demand by being tuned to receive and decode specific digital media streams modulated within specified RF channels. Tuning of these example set-top boxes to a tuned channel carrying content on-demand, may be effected by remotely tuning an example box to receive a particular RF channel to extract an identified MPEG 2 stream within this RF channel. Remote tuning commands may be issued by controller **48**, for receipt in a defined control channel at the customer set-top boxes interconnected with a distribution node 76. Other example media receivers could be remotely tuned in other ways readily appreciated by those of ordinary skill. For example, conceivably some media receivers could be tuned to receive a channel within a multiplexed data stream without being tuned to a specific RF channel.

**[0038]** **FIG. 3** illustrates in greater detail exemplary database **62**. The database **62** contains account, session, channel and other information used to establish and maintain content on-demand sessions between the multimedia server **46** and media receivers **52**. In the illustrated embodiment, database **62** is a relational database.

**[0039]** As illustrated in **FIG. 3**, example database **62** is organized as a plurality of tables that may be queried by a database engine using conventional (e.g. SQL) commands. Specifically, example database **62** includes a customer table **300** (CUSTOMER); media receiver table **302** (MEDIA_RECEIVER); account table **304** (ACCOUNT); node table **306** (NODE); session table **308**

(SESSION); RF channel group table **310** (RF_CHANNEL_GROUP); RF channel table **312** (RF_CHANNEL); content table **314** (CONTENT); and MPEG channel table **316** (MPEG_CHANNEL).

**[0040]** It will be appreciated that the illustrated structure of database **62** is simplified. Depending on the nature of additional features of system **10**, that are not detailed herein, database **62** may include many more tables. Similarly, each illustrated table may include many more columns (or fields) than those detailed herein.

**[0041]** As will become apparent, for any particular distribution node 76, populated node table **306**, RF channel group table **310**, RF channel table **312** and MPEG channel table **316** provide complete information about bandwidth used and available for delivery of content on-demand on network **50**. For any particular customer, customer table **300**, media receiver table **302** and account table **304** store information about the customer's account preferences and customer premises equipment on network **50**. As content is ordered, information about the ordered content identifying both the customer ordering the content and the network resources used to deliver the content is stored in session table **308** and MPEG channel table **316**. Content table **314** further stores information about content that is available for on-demand delivery.

**[0042]** As illustrated, node table **306** stores a record identifying each distribution node 76, capable of delivering content on-demand. Node table **306** includes a node identifier field **306a** (NODE_ID) and a hub field **306b** (HUB) identifying an associated hub **74**.

**[0043]** RF channel group table **310** identifies RF channels used for delivering content on-demand at a particular distribution node 76. RF channel group table **310** includes an RF channel group identifier field **310a** (GROUP_ID) and node identifier field **310b** (NODE_ID) used to store an identifier of the node associated with the identified channel group.

**[0044]** RF channel table **312** stores information about the use and availability of each RF channel within an RF channel group at a particular node. Each RF channel is preferably reserved for transporting data receivable by a particular type of set-top box. RF channel table **312** includes an RF channel identifier field **312a** (RF_CHANNEL_ID); a maximum RF channel capacity **312b** (MAX_CAPACITY); an available RF channel capacity field **312c** (AVAIL_CAPACITY); a channel type field **312d** (TYPE); and frequency (FREQUENCY) **312e**. A further field **312f** (GROUP_ID) stores an identifier of the RF channel group of which the current RF channel is a part – linking the RF channel to a group of RF channels that can be correlated to one or more nodes. Certain fields (e.g. field **312b** (MAX_CAPACITY)) of the RF channel table **312** are populated on system initialization and remain static during system operation, while others (e.g. field **312c** (AVAIL_CAPACITY)) may be dynamically updated based on current system conditions.

**[0045]** In the example embodiment, some RF channels are reserved for use with set-top boxes capable of receiving 256 QAM signals; others are reserved for 64 QAM signals. As such, the maximum bandwidth (e.g. 37.8 Mbps for 256 QAM or 27 Mbps for 64 QAM) of a particular channel is stored in MAX_CAPACITY field **312b**. The currently available channel capacity (i.e. unused bandwidth), which is initially set to the maximum capacity for the channel, is maintained in the AVAIL_CAPACITY field **312c**. As noted, field **312c** may be updated dynamically as an RF channel is used to carry content on-demand. The channel type is stored in TYPE field **312d**. This indicator can used to identify that the particular modulation scheme used for that channel [e.g. 64 vs. 256 QAM, etc.].

**[0046]** Account table **304** stores records associated with customer accounts. Account table **304** includes fields for storing data representative of an account identifier **304a** (ACCT_ID); accumulated charges **304b** (CHARGES) for storing accrued charges for ordered content on-demand; and a node identifier **304c** (NODE_ID) of the node with which the customer account is associated (the latter

typically being determined by the customer's geographical location). Each entry in account table **304** may be associated with multiple customers. For example, an account may be associated with multiple family members.

**[0047]** Customer table **300** stores records identifying customers of the content on-demand system **10**. Customer table **300** thus includes fields for storing data representative of a unique customer identifier **300a** (CUSTOMER_ID); password **300**b (PASSWORD); and content access level **300c** (ACCESS_LEVEL). Also included in customer table **300** is an ACCT_ID field **300d** for containing an identifier of the account with which the customer is associated. The access level stored in field **300c** is a rating level (e.g. a Motion Picture Association (MPA) rating such as "PG" or "G") and may be used to limit available content for certain customers, e.g., certain household members.

**[0048]** Media receiver table **302** stores information regarding media receivers **52** of the customers of the content on-demand system **10**. Each entry of media receiver table **302** includes a field suitable for containing a unique media receiver identifier (RCVR_ID) **302a** and receiver type (RCVR_TYPE) **302b**. The receiver type field **302b** used by the system **10** to ascertain the capabilities of a customer media receiver, and may include an indication of the make and model of a customer's set-top box **80**, for example. Also included in media receiver table **302** is an ACCT_ID field **302c** identifying the account with which the receiver is associated. Receiver table **302** further includes a media receiver name field **302d** (RCVR_NAME) for storing a receiver name recognizable by the customer (e.g. "living room TV").

**[0049]** Node table **306** stores information about each distribution node 76 on network **50** capable of providing content on-demand. The node is uniquely identified in field **306a** (NODE_ID), and the hub **74** with which the node is associated is identified in field **306b**.

**[0050]** RF channel group table **310** identifies the RF channel group allocated for use in delivery of content on-demand to customers for each distribution node

76 of network **50**. Each group is uniquely identified by a group identifier (GROUP_ID) in field **310a**. An identifier of the associated node is stored in the NODE_ID field **310b**. Conveniently, one or more RF channels can be related to one or more nodes.

**[0051]** As may be appreciated, tables **306** and **312** are typically populated by a network operator upon set-up of system **10**. RF channel group table **310** may similarly be partially populated upon network configuration with data representative of the system's node and RF channel configuration, by an operator of network **50**. Barring any reconfiguration by this operator of network **50**, the initial configured values of these records may persist unchanged throughout the operation of system **10**.

**[0052]** Within each RF channel of the present embodiment, multiple channels capable of carrying content on-demand to customers are pre-allocated. In an example embodiment, content is encoded as MPEG data, and these channels are thus referred to as MPEG channels. Each MPEG channel is thus associated with an RF channel, and moreover has an MPEG ID unique to that RF channel. In this arrangement, the combination of an RF channel ID and an MPEG ID is sufficient to allow a channel to be tuned. MPEG channel table **316** stores information about these MPEG channels. Channel table **316** includes fields for storing an MPEG channel identifier **316**a (MPEG_CHANNEL_ID); an operative transmission bit rate **316c** (BIT_RATE); and a session identifier **316d** (SESSION_ID) of the associated session; and an RF channel identifier **316e** (RF_CHANNEL_ID) of the containing RF channel. An MPEG channel status **316b** field stores information indicative of the current use of the MPEG channel. If the MPEG channel is currently being used by a session it is set to a 'used' state. When the channel is available for use by the system **10** it may be set to a 'free' state. In the present embodiment, MPEG channel table **316** is a pre-built table of all the MPEG channels. Currently set-top box software requires that the MPEG channel in system **10** match the MPEG channel maps configured on the set-top boxes. Thus the MPEG channel table **316** is typically created to match

the MPEG channel to which the set-top boxes may be tuned. Alternatively, table **316** can be a dynamically established with rows created and deleted based upon orders.

**[0053]** Content table **314** stores information about the content that is available for on-demand delivery by the system **10**. Content table **314** includes fields for storing a content identifier **314a** (CONTENT_ID); a content type **314**b (e.g. video or audio) (CONTENT_TYPE); a content rating **314c** (RATING); a bit rate **314d** at which the content is to be streamed (BIT_RATE); a duration **314**e (DURATION), i.e. the playing time of the content; and a content title **314f** (TITLE) for presentation to a customer. Content table **314** is typically updated as content is added to or removed from media server **46**.

**[0054]** Session table **308** stores information about in-progress customer content on-demand delivery sessions. Session table **308** includes fields for storing a unique session identifier **308**a (SESSION_ID); a playing minutes remaining value **308**b (TIME_REMAIN); a session expiry time **308**c (EXPIRY_TIME); a current position (i.e. the current playing position of the content, in elapse minutes for example) **308**d (CURRENT_POSITION); a session status (e.g. playing, paused, stopped, etc.) **308**e (STATUS); an associated MPEG channel identifier **308**f (MPEG_CHANNEL_ID); an identifier of the associated selected content **308**g (CONTENT_ID); and an associated customer identifier **308**h (CUSTOMER_ID).

**[0055]** Upon customer registration for receipt of content on-demand delivery, the customer table **300**, account table **304**, and receiver table **302** are populated with records representative of the current customers to the system **10**. Customer registration may occur at any time following system initialization.

**[0056]** More specifically, when a customer registers to receive content on-demand, a customer record is created within customer table **300**. A unique identifier is assigned to the customer and stored within the record's CUSTOMER_ID field **300a**. The customer may be associated with an existing

account. For example, if the new customer shares a residence with an existing customer having an established account, the customers may wish to share the account for convenience of billing reasons. Alternatively, if the customer does not wish to be associated with an existing account, a new account record is created. A unique identifier is created and used to populate ACCT_ID field **304a**; the CHARGES field **304b** is initially zeroed (to reflect no purchased content on-demand to date); and the NODE_ID in field **304c** is populated with an identity of the node with which the customer is associated as a result of geographic location. Regardless of whether the account with which the customer is associated is newly created or existing, the ACCT_ID field **300d** of the customer record is set to refer to that account.

**[0057]** The customer record in customer table **300** is further populated with a password and access level stored in fields **300b** and **300c** respectively. The access level defines an upper limit for the rating of content that may be delivered to the customer in question. For example, assuming that Motion Picture Association (MPA) ratings are used, an access level of "PG" may indicate that only "PG" or "G" rated content may be delivered to the customer. Other (i.e. non-MPA) rating systems may be employed. It will be appreciated that access levels are associated with customers rather than with accounts. Thus two customers who share an account may have different access levels.

**[0058]** It will be appreciated that at least one media receiver record (associated with a media receiver **52** of the customer) will be associated with the customer's account. This record may either be created in media receiver table **302** upon customer registration (e.g. when a new customer account is created) or may be pre-existing in table **302** (e.g. when a new customer is added to an existing account). When the media receiver record is created, a unique RCVR_ID is assigned and stored in field **302a**, and the RCVR_TYPE field **302b** is populated with a value indicative of the media receiver's capabilities (e.g. a set-top box make and model). Moreover, the ACCT_ID field **302c** is populated with the ID of the associated account. As well, a string comprising a name of the

media receiver that is recognizable by the user (e.g. "living room TV"), for which the registering customer may be prompted, is stored in the RCVR_NAME field **302d**. It will be appreciated that an account may be associated with more than one media receiver. Thus, multiple records in table **302** may be associated with a single account.

**[0059]** After creation of a suitable entry within customer table **300,** account table **304**, and media receiver table **302**, database **62** stores sufficient information to permit a customer to access system **10** to place on-demand orders. At this time, a registered customer may access system **10** to place on-demand orders.

**[0060]** In operation, a customer may order content on-demand after the customer has been registered at system **10**, and suitable records of tables **300, 302**, **304** and **316** have been populated as described above. Specifically, a customer may initially contact system **10** by establishing a data network session with server **22** using data network **20**. This may be done by simply using a conventional web browser at device **12** to contact server **22** using a published internet URL. Steps **800** performed at server **22** under control of software **30** are illustrated in **FIGS. 8A-8C**.

**[0061]** Once contacted, server **22** prompts the customer for a customer log-in and password in step **S802**. Once log-in and password are received, server **22** queries database **62** to authenticate the customer against entries within customer table **300**. That is, software **30** assesses if a record with matching CUSTOMER_ID (field **300a**) and password (field **300c**) exists. If so, the customer is appropriately authenticated, and server **22** may retrieve account information from tables **300-316** of database **62** in step **S804**.

**[0062]** Next, in step **S806** server **22** presents to device **12** a suitable user interface including one or more windows or screens for ordering and controlling delivery of content on-demand. As will be appreciated, the exact nature of the user interface may depend largely on the nature of device **12**. The user interface

may be presented in many ways. For example, the user interface may be an interface presented in a graphical operating system. It could include one or more windows presented as the result of software at the device. It could similarly include multiple screens. Alternatively, it may only include a few characters or symbols presented on a less capable device. The user interface may, for example, be provided to device **12** as a Java applet stored within files in non-volatile memory **28** and provided over network **20**. Alternatively, the interface may be provided by way of a conventional HTML page, or the like.

**[0063]** In the illustrated embodiment, the user interface includes multiple windows. Each illustrated window may be presented in a separately managed browser window at device **12**. Alternatively, the content of these windows could be presented in any number of ways – as separate screens; as a single window; or the like.

**[0064]** In step **S808**, server **22** determines whether the particular customer has an in-progress content on-demand session. This may be accomplished by querying SESSION table **308** for entries identifying the customer in question by CUSTOMER_ID in field **308h**.

**[0065]** If no sessions are in progress, network server **22** may prompt the customer for content to be ordered at device **12**, and receive the content selection of the customer, in step **S814**. Possibly, the user interface presented to the user may present a list of currently available offerings, extracted from content table **314** of database **62**. Optionally, preview data in the form of graphics, sound clips, streaming video trailers, or the like may be presented as part of the user interface provided over network **20**, in a conventional manner. These may also be stored within non-volatile memory **28** or at database **62**. Conveniently, only those offerings consistent with the operative customer access level need be presented (e.g. for parental control). Offerings may be filtered by ensuring that rating field **314c** for each offered content is consistent with access level stored in field **300c** for the customer.

**[0066]** As will be appreciated, the variety of content available on-demand that may be offered is only limited by the storage capacity associated with media server **46**. As such, the list of available titles presented to device **12** may be extremely broad. Conveniently, software and HTML files at server **22** may easily be arranged to present content in an easily accessible manner at device **12**. Content may, for example, be ordered, hyper-linked, and searched in various ways. Typically, the title of the content is displayed, optionally along with its duration and rating; this information is retrieved from fields **314f**, **314e** and **314c** (respectively) of content table **314**. Conveniently, content may be grouped by content type (e.g. video, audio, etc.) for example, as discerned from field **314b**. Advantageously, the flexibility of locating software at server **22** in combination with a relatively capable browsing device at device **12** provide the network operator great flexibility, and may offer the customer a familiar framework (e.g. web search tools) for finding desired content.

**[0067]** Once an order is received in step **S814**, a total allowed maximum playing duration and session expiry time may be calculated in step **S816**. The maximum playing duration is preferably based on the length of the ordered content (as for example, stored in field **314c** for the content), and may be a multiple thereof. In the preferred embodiment the maximum playing duration is set to equal 2.5 times the length of the content. As well, the session expiry time may be set to define a particular time window (e.g. ordering time plus 24 hours). As will become apparent, maximum playing duration and session expiry time are used by system **10** to limit how often and for how long a customer may play a piece of content delivered on-demand. Specifically, as will become apparent, a customer may play an ordered piece of content for exactly the amount of viewing/listening time allotted and specified by the maximum playing duration. However, the content can only played back after the order is placed and before the expiry time.

**[0068]** In step **S817** a confirmation window or screen may be presented to the customer, at device **12**. An example confirmation window **400** is illustrated in

**FIG. 4.** As illustrated, the expiry time and remaining playing duration are presented as part of this window **400**.

**[0069]** Confirmation window **400** may further prompt for the input of additional information, provided to server **22** in step **S818**. For example, as illustrated, confirmation window **400** includes input field **410** for receiving an identifier of one or more customer media receivers **52**, as associated with the particular customer in media receiver table **302** of database **62**. The list of client display terminals may be formed from the contents of media receiver table **302**, displaying all media receivers associated with the subject customer, for example by name as stored in field **302**d.

**[0070]** Once the order has been confirmed, server **22** verifies that sufficient allocated bandwidth remains available to deliver the content on-demand to the customer over network **50**. That is, as bandwidth is allocated on a per-node basis, and this bandwidth is shared among all customers at the node, server **22** ensures that sufficient bandwidth exists for the subject on-demand order.

**[0071]** Specifically, in step **S826**, server **22** queries node table **306** of database **62** to identify the distribution node 76 associated with the customer. Next, server **22** queries RF channel group table **310** and RF channel table **312** to attempt to locate an RF channel within the RF channel group associated with distribution node 76 for transporting content on-demand. The RF channel type (as stored in TYPE field **312d**) should be compatible with the modulation scheme understood by the set-top box **80** at the customer premises (as assessed from RCVR_TYPE field **302b**), and having sufficient remaining bandwidth (as determined from the AVAIL_CAPACITY field **312c**) to carry desired content. If it is determined in step **S826** that no such RF channel is available, a message may be displayed in step **S828**, the order process may be aborted, and steps **S806** and onward may be repeated.

**[0072]** If the required bandwidth is available, an RF channel is identified, and a pre-allocated channel for carrying an MPEG 2 stream is chosen within this RF

channel in step **S830**. The pool of MPEG IDs of the pre-allocated channels is divided into ranges or blocks, with each range being associated with a particular content rating. The MPEG channel is chosen such that its MPEG ID is in a block with an access level corresponding to the chosen content. This minimizes the likelihood of inadvertently streaming content of an unsuitable rating to a customer. The associated MPEG channel record within table **316**, is populated with a bit rate in its BIT_RATE field **316c** that is indicative of the channel's bit rate. The bit rate may, for example, depend on the nature of the content, requested by the customer and may be determined from the BIT_RATE field **314d** of the associated content record. The STATUS field **316b** is populated with a status indicator of "used" to reflect the current channel status.

**[0073]** Additionally, a session record reflecting the placed content on-demand order and ensuing session is created in SESSION table **308**, in step **S832**. Specifically, a newly formed record in SESSION table **308** is populated with a unique session ID in field **308a**, which ID also populates the SESSION_ID field **316d** of the associated MPEG channel record in table **316**. Total rental minutes and expiry time calculated in step **S816** are stored within fields **308b** and **308c**, respectively. The allocated MPEG ID (in an associated record of table **316**) is stored in field **308f**, and an identifier of the ordered content is stored in field **308g**. Current position field **308d** of the ordered content is populated with a value reflecting the commencement of the provision of content. Status field **308e** is populated to indicate that content is being streamed (i.e. played). Further, MPEG_CHANNEL_ID field **308f**, CONTENT_ID field **308g**, and CUSTOMER_ID field **308h** are populated with appropriate values associating corresponding records within tables **316**, **314** and **300** respectively.

**[0074]** As well, the AVAIL_CAPACITY field **312c** for the relevant RF channel is updated in step **S834** to appropriately decrement the available bandwidth of the RF channel carrying the stream. Further, the account charges in field **304b** may be incremented.

**[0075]** At this stage, media server **46** is instructed to stream the content with the designated MPEG ID, on the chosen RF channel at the desired distribution node 76 in step **S836**. As well, server **22** issues a command to controller **48** (by way of proxy **34**) to tune the customer set-top box **80** to which the MPEG stream is destined to the appropriate MPEG channel in step **S838**.

**[0076]** Conveniently, in manners exemplary of embodiments of the present invention, set-top box **80** of media receiver **52** which receives content delivered on-demand, is tuned by controller **48** to an RF channel and MPEG stream not regularly accessible by that set-top box **80**. That is, channels allocated for delivery of content on-demand to set-top boxes are chosen so as to not be tunables at the set-top box or by a remote control. Controller **48**, however, may remotely tune these set-top boxes **80** to the content on-demand channel. In this way, although content on-demand for one media receiver **52** (and therefore one customer) is provided to an entire distribution node 76, only the set-top box **80** associated with the on-demand session and customer will be tuned remotely to the channel carrying the content on-demand to media receiver **52**. Advantageously, no encryption is required, even though content may optionally be encrypted and decrypted at the set-top box **80**.

**[0077]** Once the customer media receiver **52** is tuned, server **22** may provide the user interface at device **12** with an additional window providing the in-progress status of content on-demand in step **S840**. Again, the window may be presented as a result of HTML, Java™ or similar data in memory **28** (**FIG. 1**). This window may be displayed by the web browser at device **12**. Conveniently, the user interface may be updated periodically, or as certain events happen, so that it is updated in substantially real time. An example window **500** is illustrated in **FIG. 5**.

**[0078]** As illustrated, window **500** may include control bar **504** reminiscent of conventional playing controls, including rewind, play, fast-forward, stop, and pause buttons. A further chapter search bar **518** and current position display

**522** may indicate the elapsed time in the delivered content and provide alternative position control. As well, the order title, duration, remaining playing time and session expiry time (as contained in fields **314f**, **314e**, **308b** and **308c**) may be displayed in fields **501**, **524**, **526**, and **528**, respectively.

**[0079]** Once window **500** is displayed, it may be updated in steps **S844-S864**. Specifically, any time a session record within database **62** is updated by an external event, as determined in step **S844**, window **500** may be updated to reflect the updated session in step **S846** and **S848**. Window **500** may refresh periodically, and thereby update its contents.

**[0080]** As well, window **500** includes control buttons that transfer/submit data to server **22**. That is, if any of the control buttons are pressed, corresponding data is sent to server **22** by the applet or application displaying the window **500**. Thus, if data representative of a stop command is received at server **22**, as determined in step **S850**, window **500** is updated to reflect stopped playing in step **S852**. As well, in step **S856**, and media server **46** is instructed to cease streaming of the particular MPEG stream. Further, the status field **308e** of the session record is updated to reflect that playing has stopped, and the status of the MPEG channel in field **316b** is set to free in step **S858**. As well, the available bandwidth maintained in field **312b** is incremented to reflect the freed MPEG channel. Thereafter, the customer may again be presented with the initial selection window as steps **S806** and onward are repeated.

**[0081]** Additionally, as set-top box **80** at media receiver **52** chosen by the customer may be independently tuned, by for example a remote control at the customer premises, it remains possible that the customer set-top box **80** may be inadvertently tuned away from the allocated RF/MPEG **2** channel in the midst of a on-demand session. In this case, the set-top box **80** cannot be tuned locally to receive the on-demand stream. Window **500** according contemplates re-tuning the set-top box by interaction with button **520**. Pressing of this button **520**, generates a data packet recognized at server **22** in step **S852**. Server **22**, in turn

re-issues the tune command to controller **48** based on the RF_CHANNEL and MPEG_CHANNEL_ID associated with the session being controlled by window **500** in step **S855**.

**[0082]** Similarly, in the event data representative of other user interaction is received at server **22**, as determined in step **S862**, a suitable command is forwarded to media server **46** in step **S864**.

**[0083]** In the event that a customer shuts down network device **12**, or decides to cease display of user interface **500**, the customer may at any time resume contact with server **22** by way of network **20**, using a device in communication with network **20**. Beneficially, the status of in-progress sessions are maintained by proxy **34**. If a session is already associated with a customer as that customer is authenticated in steps **S804-808**, information about existing sessions for that customer may be provided after log-on in step **S812**. Specifically, a session in progress window **600**, illustrated in **FIG.6** may be presented to device **12** as part of the user interface, if sessions are in progress. As illustrated, summary information regarding order sessions may be presented, and play-back of stopped content streams may be resumed. In the event resumption of a particular content stream is chosen in step **S812**, confirmation window **700** illustrated in **FIG. 7** may also be presented for that chosen session in step **S812**. As illustrated, window **700** is similar to window **400** (**FIG. 4**) and may be used to provide additional information to server **22**, including a potentially newly selected display device for a suspended (i.e. "stopped") content. Advantageously, interaction with window **700** allows the customer to resume playing of content on another media receiver associated with the customer's account. Once the session is confirmed, steps **S834** and onward are performed.

**[0084]** Once a session is established software at server **22** and the status of media server **46** are not synchronous. Database **62** is used to pass data about playing between server **22** and media server **46**. Commands controlling media server **46** issued by server **22** in response to customer requests are issued to

proxy **34**. These commands may, for example, be text commands in data packets forwarded over the Ethernet connecting proxy **34** with server **22**. Proxy **34**, in turn converts the received commands into suitable instructions understood by controller **48** and media server **46**. As required, proxy **34** may also query and update database **62**, as detailed below. In this way, server **22** may co-operate with multiple controllers (like controller **48**) and media servers (like media server **46**) from different manufacturers. Only application software **42** at proxy **34** need be updated to communicate with different media servers, control channel servers, and the like.

**[0085]** In any event, steps **900** performed at proxy **34** under control of application software **42** in response to commands received from proxy **34** and data received from proxy **34** are illustrated in **FIGS. 9A** and **9B**. Steps **900** are preferably performed for each in-progress session for delivery of content on-demand. As illustrated, a received set-top box tune command is translated forwarded to controller **48** in steps **S902** and **S904** (**FIG. 9A**). A command to stream content is translated and forwarded to media server **46** in steps **S906** and **S908**. A command to terminate provision of content on-demand to a media receiver **52** is translated in step **S910** and provided to media server **46** in step **S912**. Other commands (slow-motion; fast forward, pause, rewind, etc.) may similarly be translated in step **S914** and **S916**.

**[0086]** Proxy **34** similarly translates incoming status messages from media server **46** and controller **48**, and updates database **62**, as required. Thus, for example, a message from media server **46** indicating completion of playing results in receipt and translation of a message in step **S920** and **S922**, with a corresponding update of status field **308**e of session table **308**. More specifically, the message from media server **46** will typically include an identifier of the MPEG **2** stream that has completed. Proxy **34** may query database **62** to find an associated session record, and update field **308**e of that record. Similarly, as rewind, fast-forward and similar playing commands are issued to media server **46** one or more messages representative of the current playing

position within an available stream may be provided to proxy **34**, by media server **46**. Again, the corresponding fields of the session record may be updated (e.g. step **S918**). Proxy **34** may periodically poll media server **46** to obtain status updates for each in-progress session. Database **62** is updated appropriately.

**[0087]** As well, once the maximum playing time has elapsed for a session, or once the expiry time passed, as determined in steps **S924** and **S926**, proxy **34** may terminate the session by instructing media server **46** to cease streaming content in step **S928**, and by deleting the associated session record stored in table **308**, setting the status field **316b** of the associated MPEG channel record to 'free', and updating available bandwidth field **312c** at the node in RF channel table **312** in step **S930**.

**[0088]** A further background process **950** executing at proxy **34** and illustrated in **FIG. 9C** may update the remaining playing minutes left. This may be accomplished by tracking time at proxy **34** and periodically adjusting the value of fields **308b** (PLAYING_TIME_REMAINING) in database **62**, for all in-progress sessions, as indicated by status field **308e**. Specifically, at a fixed refresh interval (step **S952**) any sessions (step **S954**) currently having a status indicating "playing", or "paused" (vs. "stopped"), may have associated remaining time fields **308**b updated (step **S956**) to reflect elapsed time. In this way, each session may be terminated in steps **S924-S928**, as described above.

**[0089]** As illustrated in **FIG. 10**, commands received from proxy **34** are processed at media server **46**, in step **S1004**. As will be appreciated, the format of the commands provided to media server **46** will depend on the exact type of media server **46** used. That is, each media server vendor typically chooses a protocol unique to that vendor for control of the server session creation, media playback and session tear-down. As such, proxy **34** translates media play requests (session setup, playback and session tear down) from serve **22** to the appropriate command protocol required by the media server **46**.

**[0090]** As should now be appreciated, a suitable user interface is provided by

server **22** to customer device **12**, to control playing at customer media receiver **52**. An association between device **12** and media receiver **52** for each customer is stored at server **22**. This association may be varied as required. For example, a single customer account may be associated with multiple media receivers, thereby allowing a single device **12** act as an interface for multiple media receivers.

**[0091]** Advantageously, as content on-demand services evolve, new user interfaces may be stored at server **22** and provided to device **12** owned by customers. Upgrades to device **12** are the responsibility and expense of the customer. As device **12** has multiple purposes, upgrades will typically be motivated by customer interests not necessarily related to receipt of content on-demand services.

**[0092]** Further, as one device is used to select and order content-on demand, selections may be made at that device while content is being delivered to a suitably tuned receiver, or while other content is being presented. In this way browsing and ordering need not interfere with the enjoyment of other programming.

**[0093]** As noted, suitable interfaces may be provided to portable devices, such as personal digital assistants or cellular telephones, by way of a wireless data network, such as for example a G3 compliant network. As such, customers may use the portable devices in much the same way as convention infrared remote controls are used. Control commands issued by these devices, however, will travel back to system **10** by way of server **22** for ultimately control of provided content.

**[0094]** Of course, the above described embodiments, are intended to be illustrative only and in no way limiting. The described embodiments of carrying out the invention, are susceptible to many modifications of form, arrangement of parts, details and order of operation. The invention, rather, is intended to encompass all such modification within its scope, as defined by the claims.